

ALKALOIDS FROM THAI TREES USED IN FOLK MEDICINE

by

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In the forests of Thailand many trees are known which are used in folk medicine. It was tried to collect data about those species. The results are given in table 1.

In a first investigation the plant material was analysed for the presence of alkaloids, as this group of compounds is well known as physiological effective substances. The alkaloids were detected by spot tests, and separated from other extractives by thin layer chromatography.

Material and methods

Fresh plant material was collected from different areas in Thailand. After identification* it was air dried and ground by Willey mill. Except the three species *Cerbera manghas*, *Bridelia retusa*, and *Kleinhovia hospita* all the species listed in table 1 were investigated.

Spot tests

Five grams of sawdust were soaked in 7% hydrochloric acid. After filtration the solution was made alkalide and then extracted with chloroform. The chloroform extract was evaporated to 0.5 ml and spotted on paper. After spraying of the paper with the modified Dragendorff's reagent (MUNIER & MACHEBOEUF, 1949 & 1953) the alkaloid containing spots changed their colour to orange. The results are given in table 2. As some extracts were coloured by themselves, also the colour of the untreated spots were listed in table 2 for comparison.

Chromatography

The chromatographic analysis was only used for the alkaloid containing species, listed in table 2. The preparation of the plant material followed the instructions of FARNSWORTH & EULER (1962).

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Table 1: Thai trees used in folk medicine

Family	Botanical Name	Thai Name	Part of the tree	Applications and Use
<i>Anacardiaceae</i>	<i>Lannea</i> sp.	oi-chang	bark	to treat toothache
	<i>Melanorrhoea usitata</i> Wall.	rak-yai	bark	tonic, sudatorium, vomitive; to treat leprosy, syphilis, dysentery, diarrhoea, rheumatism
<i>Apocynaceae</i>	<i>Spondias pinnata</i> Kurz	ma-kok	bark	tonic, astringent; to treat dysentery
	<i>Alstonia scholaris</i> R. Br.	tin-pet	bark	astringent; to treat dysentery, intestinal worm, influenza
	<i>Cerbera manghas</i> Linn.	tin-pet-sai	bark	to treat fever, urinary calculus
	<i>Holarrhena antidysenterica</i> Wall.	mok-yai	bark	to treat dysentery
<i>Combretaceae</i>	<i>Wrightia tomentosa</i> Roem & Schult.	mok-man	bark	to treat kidney disorders
<i>Combretaceae</i>	<i>Terminalia alata</i> Heyne	rok-fa	bark	to treat diarrhoea
<i>Dilleniaceae</i>	<i>Dillenia indica</i> Linn.	ma-tat	bark	astringent
<i>Ebenaceae</i>	<i>Diospyros rhodocalyx</i> Kurz.	ta-ko-na	bark	diuretic; to treat leucorrhoea, pyorrhoea, cancer
<i>Euphorbiaceae</i>	<i>Bridelia retusa</i> Spreng	teng-nam	bark	astringent
	<i>Gelonium multiflorum</i> A. Juss. S.	khan-thong-phaya-bat	bark	purgative
<i>Guttiferae</i>	<i>Mesua ferrea</i> Linn.	bun-nak	heartwood	to treat scurvy
<i>Lauraceae</i>	<i>Cinnamomum parthenoxylon</i> Meissn.	thep-tha-ro	bark	tonic; to treat flatulency
	<i>Litsea chinensis</i> Pers.	e-men	bark	to treat dysentery, skin complaints and irritations, to assuage throes
<i>Leguminosae</i>	<i>Acacia leucophloea</i> Willd.	chalaep-daeng	bark	astringent; to treat stomach disorders, diarrhoea
	<i>Adenanthera pavonina</i> Linn.	ma-klam-ta-chang	wood	vomitive; poultices to treat headache
	<i>Albizzia lebbek</i> Benth.	phruk	bark	astringent, mouth and throat gums, to treat diarrhoea
	<i>Albizzia odoratissima</i> Benth.	khang	bark	to treat abscesses, leprosy
	<i>Bauhinia variegata</i> Linn.	sieo-dokkhao	bark	tonic, blood-stanching; to treat intestinal worms, dysentery, diarrhoea, leprosy
	<i>Cassia fistula</i> Linn.	chaiya-phruk	bark	poultices to treat carbuncle, skin irritations
	<i>Cassia siamea</i> Lamk.	khi-lek	heartwood	to treat gonorrhoea
	<i>Cassia timoriensis</i> DC.	khi-lek-luat	bark	to treat itch

<i>Leguminosae</i>	<i>Erythrina indica</i> Linn.	thong-lang-bai-mon	bark	to treat fever, swelling eyes, gall disorders
	<i>Pithecolobium bubalinum</i> Benth.	niang-nok	bark	poultices to treat chestache
<i>Lecythidaceae</i>	<i>Careya arborea</i> Roxb.	ka-don	bark	astringent, snake poison counteractive to treat muscle spasm
<i>Loganiaceae</i>	<i>Fragraea fragrans</i> Roxb.	kan-krao	heartwood	Tonic; to treat cough, asthma, malaria, smallpox, dysentery, spleen bleeding
			bark	tonic; to treat skin complaints and irritations
<i>Magnoliaceae</i>	<i>Michelia champaca</i> Linn.	champa	wood	Tonic; to treat menstruation disorders
			bark	to treat fever
<i>Meliaceae</i>	<i>Amoora polystachya</i> Hook. & Jackson	ta-sua	bark	astringent; to treat stomach disorders
	<i>Toona ciliata</i> Roem.	yom-hom	bark	astringent; to treat fever
	<i>Walsura robusta</i> Roxb.	khi-ai	bark	to treat dysentery, diarrhoea
	<i>Xylocarpus obovatus</i> A. Juss.	ta-bun-khao	bark	to treat cholera
<i>Moraceae</i>	<i>Streblus asper</i> Lour.	khoi	bark	to treat diarrhoea
<i>Myrtaceae</i>	<i>Eugenia cumini</i> Druce	wa	bark	to treat dysentery, mouth infections
	<i>Melaleuca leucadendron</i> Linn.	sa-met-khao	bark	poultices to treat ulcers
<i>Rubiaceae</i>	<i>Hymenodictyon excelsum</i> Wall.	u-lok	bark	to treat fever
<i>Salicaceae</i>	<i>Salix tetrasperma</i> Roxb.	khai-nun	bark	to treat fever
<i>Sapindaceae</i>	<i>Schleichera oleosa</i> Merr.	ta-khro-khai	bark	astringent; to treat stomach disorders
				diarrhoea
<i>Sapotaceae</i>	<i>Mimusops elengi</i> Linn.	phi-hun	bark	antiseptic to rinse mouth, throat
<i>Sterculiaceae</i>	<i>Kleinhovia hospita</i> Linn.	hatsa-khun-thet	bark	to treat skin irritations
	<i>Mansonia gagei</i> Drummond	chan-cha-mot	wood	heart tonic
<i>Ternstroemiaceae</i>	<i>Schinus molle</i> Reinw.	mang-tan	bark	nerve stimulant
<i>Thymelaeaceae</i>	<i>Aquilaria agallocha</i> Roxb.	mi-hom	wood	to treat rheumatism
<i>Ulmaceae</i>	<i>Holoptelea integrifolia</i> Planch.	ka-chao	bark	to treat rheumatism
<i>Verbenaceae</i>	<i>Avicennia officinalis</i> Linn.	sa-mae-tha-le	heartwood	vomitive, poison counteractive; to treat cough, asthma, rickets, diabetes, dropsy, gonorrhoea, diarrhoea, dysentery
			sapwood	snake poison counteractive
			bark	to treat leprosy
	<i>Callicarpa arborea</i> Roxb.	hu-khwai	bark	to treat leprosy
	<i>Tectona grandis</i> Linn.	sak	wood	to treat fever
	<i>Vitex glabrata</i> R. Br.	khai-nao	bark	astringent; to treat stomach disorders
				diarrhoea

Table 2: Results of spot tests

No.	Alkaloid containing species	Source	Colour of spots in daylight	
			untreated	Dragendorff
1	<i>Alstonia scholaris</i>	bark	faint yellow	orange
2	<i>Holarrhena antidysenterica</i>	bark	faint yellow	orange
3	<i>Wrightia tomentosa</i>	bark	colourless	pale orange
4	<i>Acacia leucophloea</i>	bark	faint yellow	orange
5	<i>Adenanthera pavonina</i>	heartwood	colourless	pale orange
6	<i>Cassia timoriensis</i>	bark	yellow green	orange
7	<i>Erythrina indica</i>	bark	faint yellow	orange
8a	<i>Fagraea fragrans</i>	bark	faint yellow	pale orange
8b	„ „	heartwood	faint yellow	orange
9a	<i>Michelia champaca</i>	bark	yellow	orange
9b	„ „	heartwood	yellow	orange
10	<i>Amoora polystachya</i>	bark	colourless	orange
11	<i>Toona ciliata</i>	bark	colourless	orange
12	<i>Streblus asper</i>	bark	colourless	pale orange
13	<i>Mimusops elengi</i>	bark	colourless	pale orange

Fraction 1. Two grams of dried plant material was moistened with 28% ammonium hydroxide and then dried on steam bath for 30 minutes, cooled, and filtered. After repeating of the procedure, the two filtrates were combined, and the solution was evaporated to 2 ml. As a high content of impurities interfered the chromatography, a further purification was necessary.

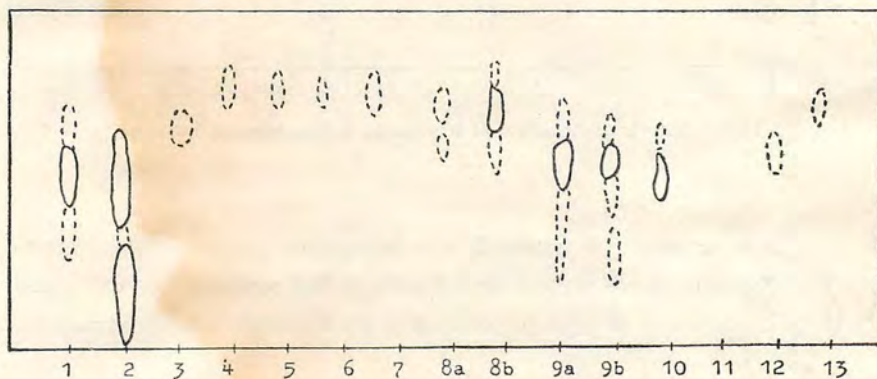


Fig. 1 : Thin layer chromatogram of Fraction 1. Sample numbers see table 2.

The chloroform solution was extracted in a separatory funnel with 1% hydrochloric acid. To the acid extract ammonium hydroxide was added until it was alkaline. From this solution the liberated bases were removed by two successive chloroform extractions. The combined extracts were evaporated to dryness, and to the residue 0.1 ml of chloroform was added. The sample represents the alkaloids equivalent to 2 grams of bark or wood and was considered to contain the majority of secondary and nitrogenous bases.

Fraction 2. To the air dried chloroform exhausted sawdust of fraction 1 15 ml ethanol, containing 0.5% hydrochloric acid, was added. The mixture was 30 minutes refluxed, cooled, filtered, and the filtrate evaporated to dryness. To the residue 1 ml water was added. The suspension was intensively stirred and then centrifuged at 1500 rpm for 10-15 minutes.

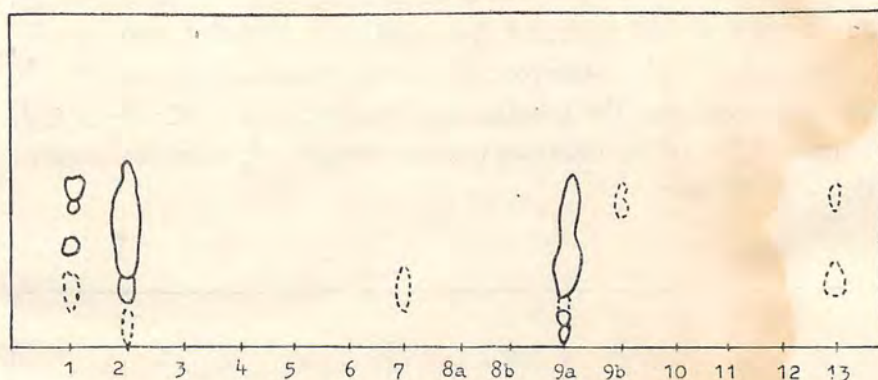


Fig. 2: Thin layer chromatogram of Fractions 2. Sample numbers see table 2.

The supernatant, Fraction 2, was considered to contain the quaternary nitrogenous bases present in the sample, but residual secondary and tertiary bases could be present too due to an incomplete first extraction.

Thin layer chromatography

The chromatographic separations were done on 20 × 20 cm plates, covered with a layer of Silica Gel G (Merck), thickness 0.25 mm. From each sample 20 μ l of Fraction 1 respectively 10 μ l of Fraction 2 were laid on the plates. The separation mixture was n-butanol-acetic acid-water (4:1:1, v/v). The development was continued until the solvent front had reached the end of the plate. Then the plate was removed, air dried, and sprayed with Dragendorff's Reagent. Orange spots showed the presence of alkaloids within the chromatogram. The results are demonstrated in Figs. 1 and 2.

Results and discussion

Forty-five tree species from Thailand, which are used in folk medicine, were analysed for the presence of alkaloids. Using the spot test method it could be demonstrated, that 13 species contain alkaloids, mostly in bark and sometimes in the heartwood too. From the 13 alkaloid containing species four belong to *Leguminosae*, and three to *Apocynaceae*.

Furthermore a chromatographic analysis was done to guarantee the spot test results. Except *Toona ciliata* all chromatograms showed the presence of one alkaloid or more. Moreover it could be demonstrated, that the alkaloids of the *Leguminosae* species probably are the same, and also the alkaloids from bark and heartwood of *Fagraea fragrans* and *Michelia champaca* respectively. The alkaloids of the *Apocynaceae* species seem to be sometimes the same. It is necessary to decide this problem of identity in further investigations. A comparison between the hitherto existing literature and our results showed a good correspondence. So it is known, that *Alstonia scholaris* contains the alkaloids ditamine, echitamine, echitamidine, and echitenine (HENRY 1949). In *Holarrhena antidysenterica* 22 alkaloids have been found (WILLIAM & SCHUBERT 1961). In *Wrightia tomentosa* (BISSET 1958), *Erythrina indica* (WILLIAM & SCHUBERT 1961), *Fagraea fragrans* (DOUGLAS & KIANG 1967), and *Mimusops elengi* (BOORSMA 1902) alkaloids of unknown chemical composition have been detected.

In contrary to our results it was found that *Eugenia cumini* contains the alkaloid jambosine (WEBB 1948), and *Hymenodictyon excelsum* contains hymenodictine (SOKOLOV 1952), but it is unknown whether the alkaloids are present in the wood, bark or other parts of the trees.

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